Anomalous RFI Detection
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My idea comes from a unsupervised machine learning viewpoint. Given a radio frequency time series $\boldsymbol{x} \in \mathbb{R}^n$, I hope to have an autoencoder model f that maps $\boldsymbol{x}$ to a reconstruction $\hat{\boldsymbol{x}} \in \mathbb{R}^n$. The hope is that our *reconstruction error* is low. We define reconstruction error to be

$$\ell(\hat{\boldsymbol{x}}, \boldsymbol{x}) = \frac{1}{n}\sum_{i=1}^{n}(\hat{x}_i - x_i)^2 = \frac{1}{n}\|\hat{\boldsymbol{x}} - \boldsymbol{x}\|_2^2 \tag{1}$$

If f is well-trained on non-anomalous data, then an anomalous example $\boldsymbol{x}$ should result in a high reconstruction error (Rajendran et al., 2018).

After training 20,000 examples in $\mathbb{R}^{500}$ and testing on rougly 17,000 examples, we obtain the following histogram. Here, the anomalous data is white noise in $\mathcal{N}(0, 1)$.

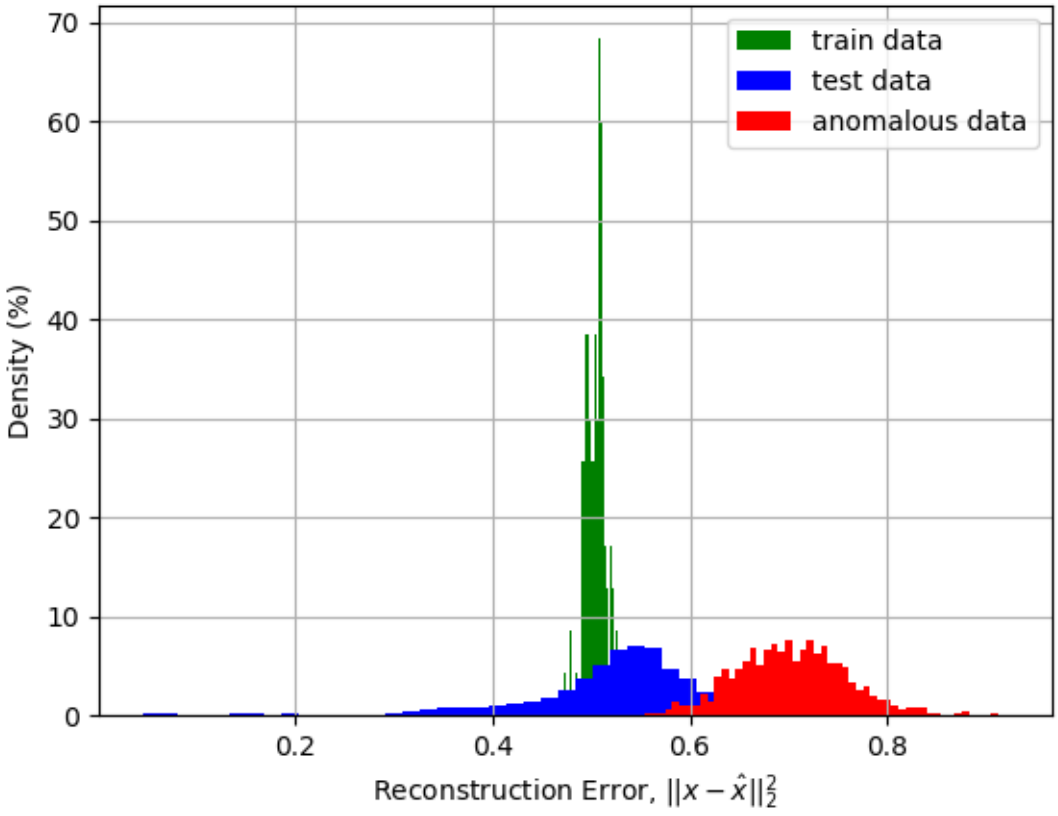

Figure 1: Reconstruction Error

References

S. Rajendran, W. Meert, V. Lenders, and S. Pollin. Saife: Unsupervised wireless spectrum anomaly detection with interpretable features. pages 1–9, 2018. URL https://arxiv.org/pdf/1807.08316.pdf.